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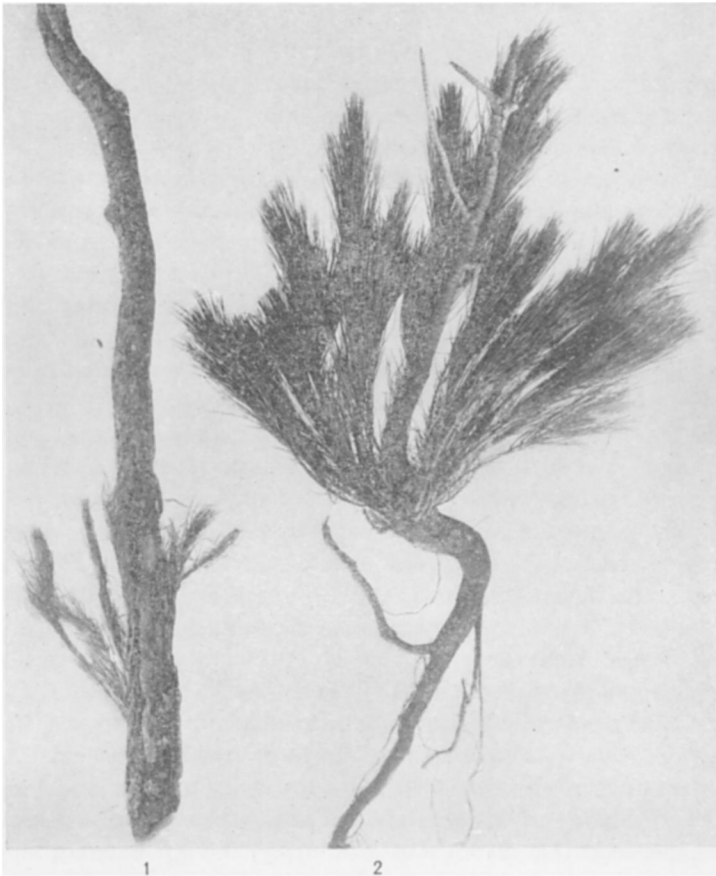
TWO SPROUTING CONIFERS OF THE SOUTHWEST

(WITH FOUR FIGURES)

The ability of conifers to produce coppice growth is limited to a few species, and most if not all of them occur in the United States. The coppicing of *Sequoia* has for a long time been a classic example, while sprout reproduction of the pitch pine (*Pinus rigida* Mill.) of the east and shortleaf pine (*Pinus echinata* Mill.) in the south is of considerable importance. During the past year extensive monogenetic reproduction of alligator juniper (*Juniperus pachyphloea* Torr.) and Chihuahua pine (*Pinus chihuahuana* Engelm.) was noted in the Garces National Forest along the international boundary between Mexico and the United States. This was very common for the region and was found in practically every stand where either of the species occurred.

The two most prominent stands of Chihuahua pine showing coppice origin were found in Boss Canyon in the Atascoso Mountains and to the south of the historic Mowry Mine in the Patagonia Mountains. The stand that occurs in Boss Canyon is especially prominent, since it extends the range for the species west of the Santa Cruz River and occurs at the remarkably low altitude of 1300 meters. Although an outlying body, it shows an optimum development for the species in the United States. According to a rough estimate, there are 500-600 Chihuahua pines over 15 cm. in diameter breast-high, with a reproduction that seems slightly inadequate to maintain the present stand. Fully two-thirds to three-fourths of the large seedlings and small saplings show severe injury by cattle, which usually consists of a broken leader and side branches (fig. 1). It is only rare seedlings in the most inaccessible areas that do not show this injury, and if it were not for the ability to sprout, reproduction would soon be missing. Typical sprouting over this area is confined to trees under 5 cm. in diameter, which send up most of the shoots from the root collar or the first 30 cm. above ground, although a large number of the saplings show groups of well formed buds at the nodes of both the leader and the branches. These buds occur for the most part on trees below 20 cm. in diameter at breast-height, and are usually confined to the lower half of the trunk and the lower portion of branches.

Near the Mowry Mine in the Patagonia Mountains there occurs a stand of Chihuahua pine which represents an excellent distribution of all sizes of trees up to 30 cm. in diameter and 9-15 meters tall. Many trees from 7.5 cm. up have been cut for mine timbers, and there is some



FIGS. 1, 2.—Fig. 1, Sprouts on Chihuahua pine as a result of injury by cattle; collected in Boss Canyon; fig. 2, Sprouts on Chihuahua pine as a result of forest fires; collected in Flux Canyon.

grazing injury. Not a single case was found where the stumps of trees smaller than 7.5 cm. in diameter had failed to produce thrifty sprouts, and fully 30-50 per cent of the stumps of trees up to 22.5 cm. in diameter had produced very thrifty sprouts, most of the fail stumps occurring

between the 15 and 22.5 cm. classes. It was only rarely that stumps over 22.5 cm. had produced any sprouts, while many stumps of 30 cm. and larger showed an entire lack of sprouting ability in older trees.

Recuperation after fire was well shown in Flux Canyon, which lies to the north of the Mowry Mine. A few scattering veterans had produced a fair amount of reproduction, which was mostly in the seedling stage. A severe ground fire which killed back several Emory oaks (*Quercus Emoryi* Torr.) and whiteleaf oaks (*Quercus hypoleuca* Engelm.) also killed back most of the Chihuahua pine reproduction. In every case where the dead leader of the pine remained, and in many cases where it was missing, 3-20 vigorous sprouts developed (fig. 2). It should not be inferred that this reproduction is more fire resistant than that of the oaks, for no information was available as to the amount and distribution of litter.

In the three stands already mentioned, as well as in various other places in the Patagonia Mountains, Canelo Hills, and Huachuca Mountains, a remarkable feature of the sprout growth was the early age at which cones were produced. A single case was found in Lyle Canyon where a tree 15 cm. in diameter breast-high and 7.5 meters tall was producing a green cone on an adventitious shoot only 30 cm. long which occurred 1.2 meters above ground. A few cases were found in which sprouts 7-10 years old were producing 1-3 cones each, and it was quite common to find sprouts 10-20 years old bearing 3-30 cones.

No study was made as to the relative rate of growth of sprouts and seedlings. Naturally the slow growth of the distinctly seedling period is not found in the sprout growth, but it is not known if the height growth of the sprouts culminates before the seedlings, as is the case with broad-leaved trees. No difference in form was noticed, although careful measurements might show a difference in form factor.

Even more remarkable is the sprouting of alligator juniper. In the northern portion of its range this species normally shows a large percentage of the trees with one or two shoots at the bases of the trees. These weak shoots are rarely over 15 cm. tall, and simply maintain life or die down, and are occasionally replaced by other equally weak shoots. In extensive trips over the Lincoln National Forest, where these small sprouts are common, not a single cut-over area showed any reproduction from the bases of the trees. There is a single tree between Capitan and Bonito, however, which was pollarded, and in May 1907 had 139 sprouts varying from 5 to 45 cm. in length (fig. 3). The same sort of sprouts were noted at the bases of trees in the Gila National Forest, but in the

vicinity of Glead, Arizona, where rare specimens of the species occur, no sprouts were found.

Along the Mexican boundary this species is usually a minor one, but it probably reaches here the maximum individual development that occurs in the United States. For the most part, it is found in valleys and canyons and on terraces and slopes, closely associated with the evergreen oaks and usually extending somewhat beyond the upper limit



FIG. 3.—Root collar sprouts and pollard sprouts on alligator juniper as a result of cutting; Lincoln National Forest, N.Mex.

of Arizona white oak (*Quercus arizonica* Sarg.). Like the Chihuahua pine, this species is not grazed by stock except in cases of starvation, but it is greatly injured by cattle which run over it to brush off flies (fig. 4). A considerable amount of cutting has been done to furnish mine timbers and fence posts.

This species does not show adventitious buds as does the pine, but when cut or broken off, it shows a much stronger tendency to produce pollard sprouts or stump sprouts than does the pine, and usually shows fully as strong a development of root collar sprouts. Out of 50 cases

noted near Oro Blanco in Cedar Creek Canyon, where the trees range from 20–30 cm. in diameter at breast-height, 39 showed vigorous sprouting. The trees had been cut by the axe, and the stumps were 30–75 cm. in height. In this canyon a count of 100 trees, broken off by cattle, which had stump diameters of 2.5–5 cm., produced very strong sprouts, with the exception of two trees which had been killed outright. The sprouts ranged from 15 to 120 cm. in height, according to age, site, vigor of tree, and number of sprouts to the stump. The most noteworthy example was a stump 1 meter tall, 25 cm. top diameter, which had produced 3 sprouts from the top of the stump. These sprouts were 2 meters tall and had basal diameters of 3.75–6.25 cm.

On the west slope of the Patagonia Mountains another count of 50 stools showed only 6 failures; 4 were stumps which were over 20 cm. in diameter, and 2 had been killed by fire. All stumps below 5 cm. in diameter were producing thrifty sprouts. Two stumps 15 cm. in diameter and 30 cm. tall were producing respectively 63 and 166 sprouts, while a third stump 12.5 cm. in diameter and 35 cm. tall was supporting 256 sprouts. Generally 3–10 sprouts are produced on each stool, and not more than 1–3 of the sprouts continue to live and grow to tree size.

In Belmont Gulch, fully 95 per cent of all reproduction of alligator juniper showed serious injury by livestock, which was almost invariably followed by sprout recuperation. In the vicinity of the Mowry Mine and in the Huachuca Mountains the injury to reproduction varied from 80 to 100 per cent. Throughout the entire region examined, the species showed its ability to reproduce by coppice, especially when the trees were less than 20 or 22.5 cm. in diameter.



FIG. 4.—Sprouts on alligator juniper as a result of grazing; collected near Flux Canyon.

A few cases were noted where sprouts were producing fruit at a very young age. On the west side of the Patagonias, a stump 15 cm. tall and 0.6 cm. top diameter had produced a sprout 1.8 meters tall and 2.5 cm. base diameter. This sprout bore 14 fully formed berries. Again, near the mountain pass on the main road between Washington Mine and Nogales, several side branches had been cut from the crown of a mature alligator juniper, and the resulting sprouts, which were 8-13 years old, ranged from 30 to 60 cm. in length. Many of them were loaded with fully formed fruits.

The sprouting ability of both these species is a controlling influence in maintaining a satisfactory reproduction in this region. Many sprouts of Chihuahua pine were found which were 10-15 cm. base diameter and 4.5-6 meters tall, and a few were found 20-22.5 cm. base diameter and 9-10.5 meters tall. Many alligator juniper sprouts were noted which were 7.5-10 cm. at the base and 4.5-4.8 meters tall. All sprouts on both species are still making a thrifty growth.—F. J. PHILLIPS, *The University of Nebraska, Lincoln.*

CELL DIVISION IN *LYNGBYA*

(PRELIMINARY NOTE)

The form here described is a large salt water species occurring at Cold Spring Harbor, L.I., and answers to the description of *Lyngbya majuscula*. In a cell of *Lyngbya* there is a large central body or nucleus, which in the stages between divisions is, except for the absence of a limiting membrane, much like the resting nuclei of the higher plants. The nucleus contains a mesh of fine fibers along which small granules are scattered. The mesh is imbedded in a clear substance resembling nuclear sap. When treated with either Haidenhain's hematoxylon or Flemming's triple, the mesh stains like linin and the granules like chromatin. Although there is no membrane or definite boundary around the nucleus, it is quite distinct from the surrounding cytoplasm. The above description is quite similar to that which OLIVE¹ gives of the nuclei of some of the Cyanophyceae studied by him.

As a cell of *Lyngbya* approaches division, fine fibers appear around the nucleus in a plane perpendicular to the longitudinal axis of the filament. These fibers, which have an appearance closely similar to that of the spindle fibers of other plants, are very numerous, and run from

¹ OLIVE, E. W., Mitotic division of the nuclei of the Cyanophyceae. Beih. Bot. Centralbl. 18:9-44. 1905.